'A' SERIES

Power Supply Handbook

Coutant Electronics Ltd.

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SECTION 1

Introduction

1.1 'A' Series modular stabilised voltage power supplies provide an extremely wide range of current and voltage combinations with current ratings of ½ to 50 amps and voltage ranges of 1 to 7.5, 6 to 15, 6 to 30 and 31-60 volts. The voltage is pre-set to a specified value during manufacture and can be subsequently altered by very simple resistor and transformer tap changes. A convenient front panel control provides a degree of voltage adjustment for each output. Twin output units are also included in the range, 6-30 volts.

1.2 The highly stable, transient free output has very low impedance and ripple voltage levels and is fully protected by a fast auto resetting overload circuit.

1.3 Any type of load can be powered by the units, two or more of which can be worked in series and a maximum of five worked in parallel with automatic current equalisation between units.

1.4 All silicon semiconductors, computer grade reservoir capacitors and printed circuit construction ensure maximum reliability over the wide temperature range.

SECTION 2

Specification

2.1	Output Voltage:	See Tables A to D.
2.2	Output Voltage Control:	A front panel potentiometer control gives a ± 1 volt adjustment. The power supplies are pre-set to a specified voltage during manufacture and subsequent changes are achieved by simple resistor and transformer tap changes.
2.3	Output Current:	See Tables A to D.
2.4	Stabilisation Ratio:	10,000: 1 for a ± 10% mains change.
2.5	Line Regulation:	0.001% for a ± 10% mains change.

2.6	Output Resistance:	Less than 1 milliohm for 7 amp units and below. Less than 0.2 milliohms for 10 amp units and above. Twin output Models of 0.5 and 1 amp output do not have remote sensing facilities and the output resistance of these units is 6 milliohms (Load regulation 6mV or 0.06%, whichever is greater) no load to full load.
2.7	Load Regulation:	1mV or 0.02%, whichever is greater, no load to full load.
2.8	Output Impedance (at any load):	Less than 0.1 ohm at 100KHz Less than 0.25 ohms at 500KHz Impedance increases linearly (approx) with increasing frequency.
2.9	Low Frequency Ripple and Noise:	Less than 200μV peak to peak (500μV for units of 15 amps and above).
2.10	Transient Response:	Approximately 10 microseconds for recovery to within 10 millivolts of nominal voltage after maximum load changes.
2.11	Temperature Range:	−10°C to +65°C.
2.12	Temperature Coefficient:	0.02%/°C (0.005%/°C optional).
2.13	Overload Protection:	The overload protection circuit operates at between 115-160% of the maximum current rating on 0.5A-7A units and between 115-140% on 10A-50A units. The characteristic is re-entrant with an initial period of about 200 milliseconds of approximate constant current operation to ensure reliable "switch on" into non-linear loads. (Patent No. 1141634)
2.14	Input Voltage:	105-125 and 210-250 volts A.C. 45-65 Hz single phase. Split primary windings are connected in parallel for 105-125V and in series for 210-250V.

Maximum permissible input supply deviation is ± 10%. Units are usually supplied set to a voltage of 240 (UK) or 220 (Europe).

A protective cover for the terminal block is supplied with each unit.

2.15 Remote Sensing: Amplifier terminals are provided on all units (with the exception of the .5 and 1 amp twin output units) so that the correct voltage may be regulated at a remote load.

2.16 Polarity: Both output rails are isolated from earth and either can be earthed.

2.17 Insulation Resistance: Withstands 500V D.C. across output terminals and earth.

Withstands 2.1KV D.C. across line, neutral and earth.

2.18 Series and Parallel Connection: Any number of units may be connected in series provided the 500 volt insulation resistance is not exceeded. Units of a similar type may be connected in parallel with the "P" terminals interconnected. The "master and slave" technique is used to ensure automatic current equalisation. See paragraph 4.2 and 4.3.

2.19 Options:

OV — Overvoltage protection circuits can be fitted internally to all units to protect voltage sensitive components connected to the output terminals of 'A' series power supplies.

Voltage rise beyond a certain limit results in the firing of an SCR which clamps the output of the unit to zero. Typical delay: 50-100μS.

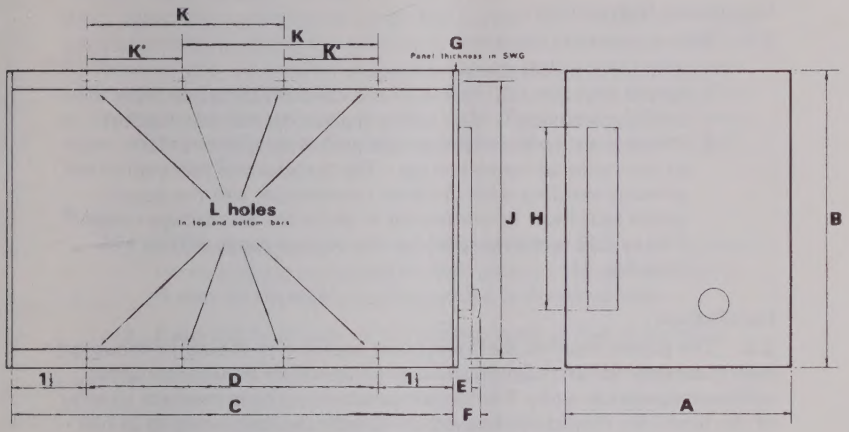
Setting: 110% of output voltage (higher for 5V units and below). See section 7 for full details.

TC — Temperature coefficient is improved from 0.02%/°C to 0.005%/°C when this option is factory fitted.

PC — Protective covers can be supplied fitted to units.

RM — Rack mounting of the size 15 units is possible with this option. A 19" front panel with handles replaces the units standard rear panel. See below for dimensions.

OUTLINE DRAWING DIMENSIONS & WEIGHTS

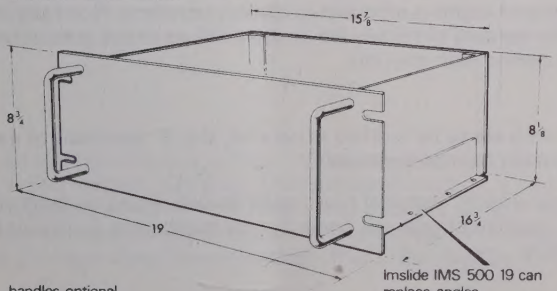


SIZE REF.	A		B		C		D		E		F		G		H		J		K		L	APPROX. WEIGHT	
	ins	mm	ins	mm	ins	mm	ins	mm	ins	mm	ins	mm	SWG.	mm	ins	mm	ins	mm	ins	mm	UNIFIED TAP	LBS	Kgs
10	3¼	83	3¼	83	7	178	4	10	5/16	8	3/8	9·5	12	2·63	2½	64	2⅞	73	–	–	6 -32U.N.C.	4	1·8
11A	5	127	3¼	83	7	178	4	102	5/16	8	3/8	9·5	12	2·63	2½	64	2⅞	73	–	–	6 -32U.N.C.	5	2·3
11B	5	127	3¼	83	7½	190	4½	114	5/16	8	3/8	9·5	12	2·63	2½	64	2⅞	73	–	–	6 -32U.N.C.	6	2·7
11C	5	127	3¼	83	9	229	6	152	5/16	8	3/8	9·5	12	2·63	2½	64	2⅞	73	–	–	6 -32U.N.C.	7	3·2
11D	5	127	3¼	83	11¼	286	8¼	210	5/16	8	3/8	9·5	12	2·63	2½	64	2⅞	73	6	152	6 -32U.N.C.	8	3·6
12	5	127	4⅛	105	11¾	298	8¾	222	13/32	10	11/16	17·5	10	3·28	3⅝	92	3¾	95	6	152	10-32U.N.F.	11	4·9
13	5	127	6½	165	11¼	286	8¼	210	13/32	10	11/16	17·5	10	3·28	3⅝	92	6⅛	56	6	152	6 -32U.N.C.	20	9·1
14A	6¾	171	8⅜	213	11¾	298	8¾	222	13/32	10	11/16	17·5	10	3·28	3"	76	8	203	6	152	10-32U.N.F.	32	14·5
14B	6¾	171	8⅜	213	15⅝	397	12⅝	321	13/32	10	11/16	17·5	10	3·28	3	76	8	203	6"	152	10-32U.N.F.	37	16·7
15	8⅛	206	17¼	438	16½	419	13½	317	⅜	16	11/16	17·5	10	3·28	3	76	16½	419	6"	152	10-32U.N.F.	75	34

15Amp units & above have O/P terminals which protrude 1in (25.4mm.) from the front panel

" For twin units read 5⅛" (130mm.)

size ref:15 19"rack version



handles optional

Imslide IMS 500 19 can replace angles

SECTION 3

Installation Instructions

3.1 Before installing the unit:

1. Check for visible transit damage.
2. Check that the A.C. fuse is of the correct rating and is an anti-surge device.* (The rating is given on the fuse holder).
3. Check that the transformer taps are set to within ± 10% of the nominal mains voltage. The transformer has a split primary winding with soldered connections and the appropriate taps must be connected in series for the voltage range 210 to 250 and in parallel for the voltage range 105 to 125. (See Fig. 1).

Installations

3.2. The power supplies are convection cooled and should be mounted with the heatsinks vertical and positioned to ensure an uninterrupted airflow through the unit. The air temperature in the immediate vicinity of the heatsinks should not exceed 65°C with the unit working at full power. If the temperature is likely to exceed this maximum the unit must be derated or force ventilated to avoid overheating.

Interconnection

3.3 All electrical connections are made to the terminal block on the front panel. See Fig, 2. *Always fully tighten the terminal block screws.*

*Some high current models use normal fast acting fuses when set at 115V A.C. nominal input. See fuse table E.

Input Connection

3.4. Connect the mains input to the A.C. terminals, Line to 'L' and Neutral to 'N'. The unit is earthed at the 'E' terminal. NEVER connect the mains to any of the output rails.

Output Connection

3.5. The output terminals comprise a positive and negative rail with positive and negative amplifier terminals between. Normally the amplifier sensing terminals are directly linked to the output rails by the strip supplied with the unit.

When units are to be worked in parallel, the 'P' terminals of each supply must be interconnected.

Warning—The 'P' terminal must never be connected or short circuited to the negative output rail under any circumstances or circuit failure will result.

Remote Sensing Connections

3.6. When the voltage drop across the output leads causes difficulty, the connection between the sensing terminals and the output rails can be removed and the sensing terminals directly connected to the load with separate leads; the correct output voltage will then be regulated at the load. An electrolytic capacitor of approximately 100u F/amp must be connected across the load to balance the inductance of the leads. See Fig. 3.

Note:

1. Route the sensing leads carefully on long cable runs to prevent mains pick-up and possible oscillation of the power supply. It may be necessary to use twisted or screened leads.
2. Keep the resistance of the sensing leads as low as possible.
3. When very long sensing leads are used it may be necessary to remove the output capacitor(s) from the unit to improve the high frequency stability of the amplifier.
4. Never disconnect the output rails with the sensing leads still connected to the load. This will burn out the low value resistors connected between the sensing rails and the output rails in the unit.

SECTION 4

Operating Instructions

4.1. Switch power to the unit and monitor the output with a suitable voltmeter. If necessary adjust the voltage level with the front panel potentiometer (RV1) which provides an adjustment of $\pm$ 1 volt. It may be possible to achieve much wider voltage variations with potentiometer control than the limits specified, but larger adjustments may cause over dissipation of the series transistors at full load, with consequent damage to the unit, particularly if the voltage is reduced excessively. Always follow the precedures outlined in the voltage adjustment section of the handbook if larger adjustments of the output voltage are necessary.

Caution:

1. **Do not** use the unit as a voltage sink by connecting the output to a source of higher voltage. (2) When Overvoltage Protection is fitted, if no output is apparent, switch off the supply and back off the overvoltage unit. Switch on the supply and adjust the overvoltage to the required level using the front panel potentiometer (RV1). See Section 7.

Parallel Operation

4.2. When operating a maximum of 5 similar units in parallel it is only necessary to interconnect all the 'P' terminals and parallel connect the outputs (Fig. 4). The unit set to the highest voltage will become the master unit and will have overriding control of the other supplies.

Where more than 5 units are used the 'P' terminal of each unit should be connected to a 47 ohm ½W Carbon resistor and the other side of each resistor returned to a common point shown dotted on Fig. 4.

The output voltage of each power supply should be set to within the limits required.

Warning—The 'P' terminal must never be connected or short circuited to the negative output rail under any circumstances or circuit failure will result.

Parallel Redundant Mode

4.3. For added reliability it may be necessary to connect a second Power supply in parallel with the first such that if the output voltage of either unit should disappear, the load will not experience any interruption in its supply voltage.

This can be achieved by connecting the units as in Fig. 5. The isolating diodes should be connected as near to the load as possible so that the sense circuit can accommodate any line voltage drops up to the diode. Under no circumstances should the sense terminals of either unit be connected to the load side of the diode. Low forward resistance diodes should be used if possible and the output voltage of both units may need to be adjusted to compensate for this. See page 12 for Fig. 5.

Warning—Do not use the 'P' terminal in this mode.

Output Voltage Changes

Important—Before commencing any procedure involving resistor changes or work on the circuit ALWAYS DISCHARGE THE RESERVOIR CAPACITORS using a low value wire wound resistor. Accidental short-circuits will not then cause any damage.

4.4. To alter the output voltage of the unit where a larger adjustment than that provided by RV1 is required, it is necessary to change the values of R7, R10 and R20 and in some cases R12. The transformer secondary taps must also be re-selected. The various values of resistor and transformer taps are given in Tables A—D.

The resistors are mounted on stand-off pillars on the amplifier printed circuit board which, in the case of the smaller supplies is easily accessible at the side of the unit. Other units have the board mounted on the front panel and it may be necessary to release the panel to gain access to the board.

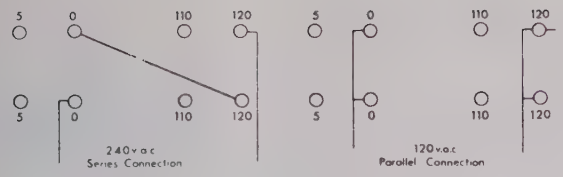


Fig.1. Typical Transformer Primary Tap Connections

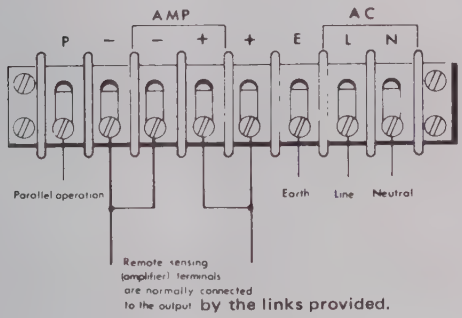


Fig.2. Typical Tagblock Connections

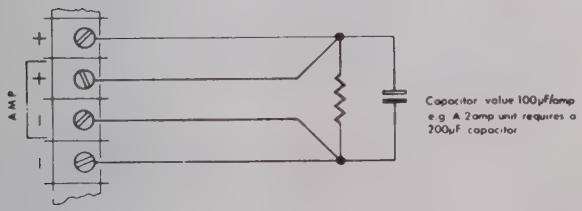


Fig.3. Remote Sensing Connection.

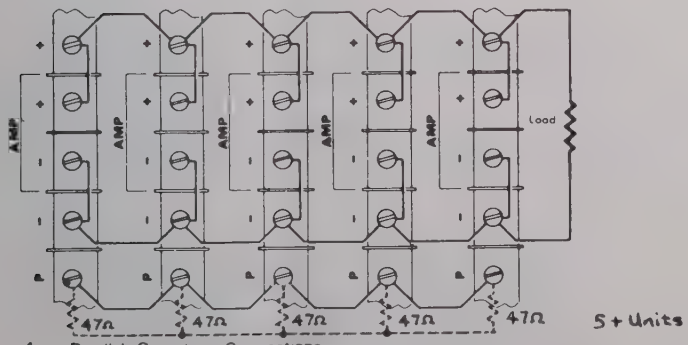
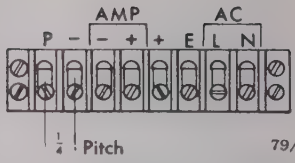


Fig 4 Parallel Operation Connections

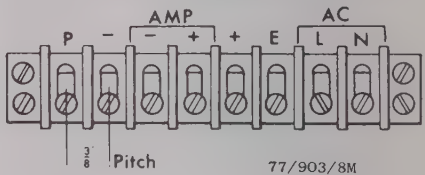
SINGLE OUTPUT MODELS

ASA 50 100 200 300
ASB 50 100 200 300
ASC 50 100 200



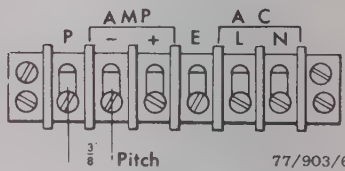
79/593/8M

ASA 500 700 1000
ASB 500 700 1000
ASC 300 500 700 1000



77/903/8M

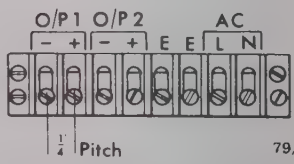
ASA 1500 2000 3000 5000
ASB 1500 2000 3000
ASC 1500 2000 3000



77/903/6M

TWIN OUTPUT MODELS

ATB 50 100
ATC 50 100

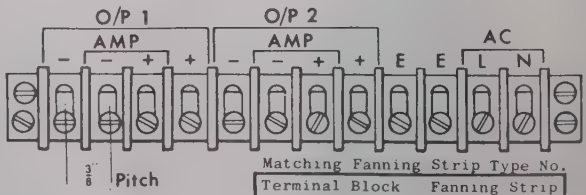


79/593/8M

ATB 300 500
ATC 200 300 500

77/903/12M

ATB 200 Terminal Block (Type No. 79/593/12M) has the same connection layout but with a pitch of ¼".



Matching Fanning Strip Type No.

Terminal Block	Fanning Strip
79/593.....	81/200
77/903.....	77/534/20

Manuf. Carr Fastener Co. Ltd.

TERMINAL BLOCK CONNECTIONS

SECTION 5

Circuit Description—refer to Section 8 for circuits

5.1. Input power is supplied to the primaries of the transformer via anti-surge fuse FS 1. The split winding is connected in series for voltages of 210-250 and in parallel for voltages 105-125.

Full wave bridge MR7-10 rectifies the output of the 22 volt secondary winding and the resulting D.C. passes to transistors VT1 and VT6 which provide a constant current output fed into three zener diodes The most negetive zener (MR2) forms the stabilised negative line of the subsidiary rail. The two most positive zeners (MR3 and 4) form the positive subsidiary line and the junction of zeners MR2 and MR3 is taken to the common reference rail which is also the positive sensing line.

The output of the main secondary winding is full wave rectified by MR11—12 diode network and the resulting D.C. output passes to the output terminals via series transistors VT50 (VT50 may consist of two or more transistors in parallel). R50 compensates for any base emitter voltage variation in VT50 and also forms part of the overload protection circuit.

Zener diode MR6 is connected via R17 to the positive subsidiary rail to provide a reference voltage from which a reference current is derived by R19. This current is compared by comparator VT5a and b with a current obtained from the output voltage by R20. Since the current in R20 is proportional to the output voltage the value of this resistor determines the output voltage of the unit. RV1 provides a degree of output voltage adjustment.

The single ended output from the comparator is taken to common emitter amplifier VT3, the emitter of which is taken to the junction of MR3 and 4. MR4 together with VT3 provides an approximate constant voltage across R16 which defines the current in VT5b. The output of VT3 provides the drive to emitter follower chain VT2 and VT51 which in turn controls the current to the base of series transistor VT50. (VT51 is not fitted on units of 2 amps and below).

Lag network R8 and C2 ensures high frequency stability of the closed loop. C4 and R18 provide a degree of ripple attenuation by by-passing R20 at ripple frequency thereby increasing the low frequency A.C. loop gain.

R12 may be incorporated to improve the output resistance by providing feed forward into comparator VT5a and b of a current proportional to the output current.

Re-entrant overload protection is provided by VT4 and related circuitry. VT4 compares the voltage across R50 with a reference voltage derived from the output by potential divider R6 and R7. (R10 is incorporated

in the potential divider circuit on units with an output of 5 volts and above). When the voltage across R50 increases sufficiently, VT4 conducts and diverts the drive current from the emitter follower chain and causes the ouput voltage and current to fall to a low level. When the trip operates VT3 is turned on but as the drive voltage is now developed across R9, this prevents VT3 interfering with the operation of VT4.

As the output voltage falls, the reference voltage at VT4 is reduced, hence the voltage drop required in R50 for conduction in VT4 is also reduced and the available current falls. Because C3 is connected to the negative subsidiary rail, an approximate constant current characteristic prevails when the unit is first switched on, until C3 is charged.

When C3 is at the same potential as the base of VT4 the normal reentrant characteristic is established. MR5 prevents C3 causing a voltage overshoot when the unit is switched off. MR50 protects the unit from reverse voltages applied across the output terminals.

Parallel Operation

5.2. Units can be operated in parallel by connecting the output and sensing terminals to the load and interconnecting the 'P' terminals. The amplifier of the unit at the highest voltage level will take control of all the units, i.e. VT3 of the master unit will provide drive to all the emitter followers.

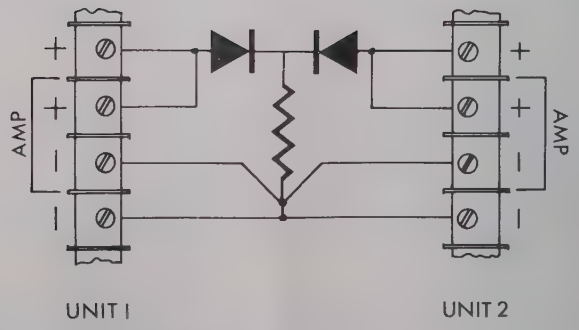


FIG.5. Parallel Redundant Connections.

SECTION 6

PARTS LIST

6.1. The following tables list those components and secondary tap connections necessary to obtain particular output voltages throughout the 'A' series range of units. The values given are only approximate due to component tolerances within the units.

6.2. The values for R10 and R7 which set the trip and short circuit current levels are approximate and are dependent upon the manufacture of the series element transistors (VT50). When selecting R10, decrease the value to increase the trip current level. When selecting R7, decrease the value to increase the short circuit current.

TABLE A
ASA RANGE

	SIZE REF.	10	10	11B	11D	12	13	14A	14B		15	15	
OUTPUT VOLTS	Model	50	100	200	300	500	700	1000	2000	TAP	3000	5000	TAP
	O/P I	0.5A	1.0A	2.0A	3.0A	5.0A	7.0A	10A	20A		30A	50A	
1–4.5V	R7	1.8K	820	1.6K	1.3K	1.0K	1.3K	1.0K	1.0K	9-0-9	910	1.2K	14-0-14
	R12	470K	470K	470K	O/C	O/C	O/C	O/C	O/C		O/C	O/C	
	R10	O/C	O/C	O/C	O/C	O/C	O/C	O/C	O/C		O/C	O/C	
	R20	100	100	100	100	100	100	100	100		100	100	
4–7.5V	R7	6.8K	2.1K	O/C	2.4K	3.0K	3.9K	3.0K	2.2K	12-0-12	3.1K	3.3K	17-0-17
	R12	1M	1M	470K	O/C	O/C	O/C	1M	O/C		O/C	O/C	
	R10	2.2K	1.0K	1.3K	2.2K	1.2K	2.4K	1.6K	1.6K		1.0K	1.3K	
	R20	270	270	270	270	270	270	270	270		270	270	

TABLE B

ASB RANGE—Note: See supplementary table for ATB Range.

	SIZE REF.	10	11A	11C	11D	12	13	13	14B	15		15		
OUTPUT VOLTS	Model	50	100	200	300	500	700	1000	1500	2000	TAP	3000	O/P Volts	TAP
	O/P I	0.5A	1.0A	2.0A	3.0A	5.0A	7.0A	10A	15A	20A				
	R7 R12	O/C 470K	O/C 2.2M	O/C 2.2M	3.9K O/C	2.7K O/C	4.3K O/C	3.6K O/C	3.3K O/C	4.3K O/C		3.6K O/C		
6–8V	R10 R20	2.2K 470	1.8K 470	1.6K 470	2.0K 470	1.2K 470	2.2K 470	1.8K 470	1.6K 470	1.2K 470	13V	1.6K 390	6-7V	18V
9–11V	R10 R20	3.0K 750	2.4K 750	2.0K 750	2.7K 750	1.9K 750	3.3K 750	3.0K 750	2.0K 750	1.6K 750	15V	2.0K 750	8-10V	22V
12–13V	R10 R20	3.6K 910	3.3K 910	2.4K 910	3.9K 910	2.2K 910	3.9K 910	3.3K 910	2.7K 1.0K	1.8K 1.0K	18V	2.2K 910	11-12V	25V
14–15V	R10 R20	4.3K 1.2K	3.9K 1.2K	3.3K 1.2K	4.7K 1.2K	2.4K 1.2K	5.1K 1.2K	4.3K 1.2K	3.9K 1.2K	3.0K 1.2K	20V	2.4K 1.2K	13-15V	29V

ATB RANGE

	SIZE REF.	11D	11D	12	13	14A	
OUTPUT VOLTS	Model	50	100	200	300	500	TAP
	O/P I	0.5A	1.0A	2.0A	3.0A	5.0A	
	R7 R12	O/C 1M	O/C 2.2M	O/C 1M	4.3K O/C	3.9K O/C	
6–8V	R10 R20	2.2K 470	2.0K 470	1.8K 470	2.2K 470	2.0K 470	13V
9–11V	R10 R20	3.3K 750	2.4K 750	2.0K 750	3.0K 750	2.7K 750	15V
12–13V	R10 R20	3.9K 1.0K	3.3K 910	2.7K 910	4.3K 910	3.3K 910	18V
14–15V	R10 R20	4.7K 1.2K	3.9K 1.2K	3.3K 1.2K	5.1K 1.2K	3.9K 1.2K	20V

TABLE C
ASC/ATC RANGE

OUTPUT VOLTS	Model	50	100	200	300	500	700	1000	1500	TAP	2000	3000	TAP
	O/P I	0.5A	1.0A	2.0A	3.0A	5.0A	7.0A	10A	15A		20A	30A	
	R7	O/C	O/C	O/C	5.1K	5.1K	5.6K	5.1K	5.1K		5.1K	5.1K	
6–8V	R10	2.0K	910	1.8K	2.2K	1.8K	2.9K	2.0K	2.0K		1.2K	1.5K	
	R12	2.2M	2.2M	1M	O/C	O/C	O/C	O/C	O/C	13	O/C	O/C	20
	R20	270	270	270	270	270	270	270	270		270	270	
9–11V	R10	2.7K	1.2K	2.2K	3.3K	3.3K	3.9K	2.7K	2.2K		1.5K	1.8K	
	R12	2.2M	2.2M	1M	O/C	O/C	O/C	O/C	O/C	16	O/C	O/C	24
	R20	560	560	560	560	560	560	560	560		560	560	
12–14V	R10	3.9K	1.6K	3.3K	3.9K	3.9K	4.7K	3.3K	2.7K		1.8K	2.2K	
	R12	2.2M	2.2M	1M	O/C	O/C	O/C	O/C	O/C	19	O/C	O/C	28
	R20	820	820	820	820	820	820	820	820		820	820	
15–17V	R10	4.3K	1.8K	3.9K	4.7K	5.1K	5.6K	3.9K	3.3K		2.2K	2.7K	
	R12	2.2M	2.2M	1M	O/C	O/C	O/C	O/C	O/C	23	O/C	O/C	34
	R20	1.2K	1.2K	1.2K	1.2K	1.2K	1.2K	1.2K	1.2K		1.2K	1.2K	
18–20V	R10	5.1K	2.2K	4.7K	6.2K	6.2K	6.2K	4.7K	3.9K		3.3K	3.3K	
	R12	2.2M	2.2M	1M	O/C	O/C	O/C	O/C	O/C	26	O/C	O/C	38
	R20	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K	1.5K		1.5K	1.5K	
21–24V	R10	6.2K	2.7K	5.6K	7.5K	8.2K	8.2K	5.1K	4.3K		3.9K	3.9K	
	R12	2.2M	2.2M	1M	O/C	O/C	O/C	O/C	O/C	29	O/C	O/C	40
	R20	1.8K	1.8K	1.8K	1.8K	1.8K	1.8K	1.8K	1.8K		1.8K	1.8K	
25–27V	R10	6.8K	3.3K	6.2K	8.2K	9.1K	9.1K	6.2K	4.7K		4.3K	4.7K	
	R12	2.2M	2.2M	1M	O/C	O/C	O/C	O/C	O/C	31	O/C	O/C	44
	R20	2.0K	2.0K	2.0K	2.0K	2.0K	2.0K	2.0K	2.0K		2.0K	2.0K	
28–30V	R10	7.5K	3.9K	7.5K	9.1K	10K	10K	7.5K	5.1K		4.7K	5.6K	
	R12	2.2M	2.2M	1M	O/C	O/C	O/C	O/C	O/C	34	O/C	O/C	48
	R20	2.4K	2.4K	2.4K	2.4K	2.4K	2.4K	2.4K	2.4K		2.4K	2.4K	

TABLE D
ASD RANGE

OUTPUT VOLTS	Model	50	100	200	300	500	TAP	1000			
	O/P I	0.5A	1.0A	2.0A	3.0A	5.0A		TAP			
	R7 R12	O/C O/C	O/C 2.2M	6.2K 2.2M	6.8K 2.2M	6.2K 2.2M					
31–33V	R10 R20	10K 200	10K 200	9.1K 200	6.2K 200	4.7K 200	36	3.6K 200	37	R7 R12	5.6K O/C
34–36V	R10 R20	10K 390	12K 390	10K 390	6.8K 390	5.1K 390	39	3.9K 390	39.5	R7 R12	5.6K O/C
37–39V	R10 R20	10K 680	12K 680	10K 680	7.5K 680	5.1K 680	41	4.8K 680	43	R7 R12	3.6K O/C
40–42V	R10 R20	12K 1.0K	12K 1.0K	10K 1.0K	8.2K 1.0K	6.2K 1.0K	46	5.1K 1.0K	45	R7 R12	6.2K O/C
43–45V	R10 R20	12K 1.3K	15K 1.3K	12K 1.3K	9.1K 1.3K	6.2K 1.3K	49	5.1K 1.3K	48	R7 R12	6.2K O/C
46–48V	R10 R20	15K 1.6K	15K 1.6K	12K 1.6K	10K 1.6K	6.8K 1.6K	51	5.6K 1.6K	51	R7 R12	6.2K 2.2M
49–51V	R10 R20	15K 2.0K	15K 2.0K	12K 2.0K	10K 1.8K	7.5K 2.0K	54	6.2K 3.0K	54	R7 R12	6.2K 2.2M
52–54V	R10 R20	15K 2.2K	15K 2.2K	15K 2.4K	10K 2.2K	7.5K 4.7K	56	6.2K 2.2K	56	R7 R12	6.2K 2.2M
55–57V	R10 R20	18K 2.4K	18K 2.4K	15K 2.4K	12K 2.4K	8.2K 2.4K	59	6.2K 2.4K	57.5	R7 R12	5.6K 2.2M
58–60V	R10 R20	18K 2.7K	18K 2.7K	18K 2.7K	12K 2.7K	9.1K 2.7K	62	6.8K 2.7K	59.5	R7 R12	4.7K 2.2M

TABLE E
FUSE RATINGS

ASA	ASB	ASC	ASD	AC FUSING 210-250	AC FUSING 105-125	Type No.	DC FUSE	(when fitted)
50	50	50	50	1A	1A	TDC 123	1A	
100	100	100	100	1A	1A	TDC 123	2A	
200	200	200	200	1A	2A	TDC 123	3A	
300	300	300	300	2A	3A	TDC 11	5A	
500	500 700	500 700	500	3A	5A	TDC 11	7A	
700				5A	5A	TDC 11	10A	
1000	1000	1000	1000	5A	7A	TDC 11	15A	
1500	1500	1500		7A	10A	TDC 11	20A	
2000	2000			7A	10A	TDC 11	30A	
3000	3000			10A	10A	TDC 11	40A	
5000		2000 3000		10A		TDC 11	60A	
5000					20A	TDC 10*	60A	*NOT ANTI-SURGE
TWIN OUTPUT UNITS								
ATB	ATC							
50	50			1A	1A	TDC 123	1A	
100	100			1A	2A	TDC 123	2A	
200	200			2A	3A	TDC 123	3A	
300	300			3A	5A	TDC 11	5A	
500	500			5A	7A	TDC 11	7A	

6.4. Components List

6.4.1 Control Boards Type 11101, 11102.

The 'A' series benefits from a high quality control circuit which is common throughout the range. This circuit is mounted on two different sizes of P.C.B. to accommodate the different mounting arrangements in some units. One P.C.B., type 11101, the smaller of the two, is fitted to the following units:—

ASA	50	ASB	50	ASC	50	ASD	300
	100		700		700		500
	700		1000		1000		1000
	1000		1500		1500		
	1500		2000		2000		
	2000		3000	ATC	300		
	3000	ATB	500		500		
	5000						

The larger P.C.B. type 11102, is fitted to the remaining units in the range and has positions for components Cct. Ref : MR11 and MR12. These components are listed with the framework components.

Note that 11101 does not accommodate these components.

The following units, using 11102, have MR11 and MR12 mounted elsewhere in the unit owing to the components size:—

ASA	500	ASB	300	ASC	300	ASD	200
			500		500		
		ATB	300				

A Series Printed Circuit Parts List

Types 11101 and 11102

†Resistors ½W 5% (Carbon film unless otherwise stated).

R1	390 ohms	High Stability
R2	82K	
R3	100 ohms	
R4	1K	
R5	10K	
R6	390 ohms	High Stability
R7	*	High Stability
R8	560 ohms	
R9	180 ohms	
R10	*	High Stability
R11	1K	
R12	*	
R13	470 ohms	
R14	2.2K	

R15	4.7K	
R16	4.7K	
R17	240 ohms	High Stability
R18	470 ohms	
R19	510 ohms	High Stability
R20	*	High Stability
R21	100 ohms	
R22	100 ohms	
R23	27K	

*See voltage Tables A to D

†Examples of Suitable Resistors:

High Stability—Electrosil TR5 (2% or 5%) metal oxide or equivalent.

Carbon Film—Waycom Piher WP051 or equivalent.

Capacitors

C1	200uF	35V Electrolytic	Wima Printilyt
C2	2200pF	400V	Wima Tropyfol M
C3	220µF	10V	Mullard 01614221
C4	4.7µF	63V	Mullard 01590003

Diodes

MR1	4.3V zener	BZY88C4V3	Mullard
MR2	5.1V zener	BZY88C5V1	Mullard
MR3	5.6V zener	BZY88C5V6	Mullard
MR4	4.3V zener	BZY88C4V3	Mullard
MR5		1N4003	Motorola
MR6	5.1V zener	BZY88C5V1	Mullard
MR7-10		1N4003	Motorola
MR11)	See framework components list and notes in		
MR12)	paragraph 6.4 above.		
MR13		1N4003	Motorola
MR14		1N4003	Motorola

Transistors

VT1	BFY51	Mullard (Alternative 2N3053)
VT2	2N1893	Micro E
VT3	BCY72	
VT4	BC108	
VT5	U415	SGS—ATES
VT6	BCY72	Mullard (Alternative SM4975)

Improved temperature coefficient (0.005%/°C) modification component changes:—

MR6	IN825A	Int. Rectifier
R19	620 ohms	5% ½W High Stability
R17	270 ohms	5% ¼W High Stability

ASA FRAMEWORK COMPONENTS

Circuit Ref.	ASA 50 / ASA 100	ASA 200	ASA 300	ASA 500	ASA 700 / ASA 1000	ASA 1500	ASA 2000	ASA 3000	ASA 5000
R50	2 ohms 5% 3W W/W	0.5 ohms 5% 5W W/W	2 x 0.5 ohms 5% 5W W/W		5 x 0.5 ohms 5% 5W W/W	6 x 0.5 ohms 5% 5W W/W	8 x 0.5 ohms 5% 5W W/W	13 x 0.5 ohms 5% 5W W/W	26 x 0.5 ohms 5% 5W W/W
R51	–	–	1K ohm 5% 3W W/W						
R52	–	–	–	–	–	330 ohms ½W		–	–
RV1	500 ohms 5% Bourns 3067 P-1-501								
C50	2700uF 25V Sprague 36D 272G 025 AA2A	5500uF 25V Sprague 36D 552G 025 AB2A		11000uF 25V Sprague 32D 113G 025 BC 2A	2 x 11000uF 25V	3 x 11000uF 25V	4 x 11000uF 25V	2 x 16000uF 30V Sprague 36D 163G 030 BD 2A	3 x 16000uF 30V
C51a	220uF 35V Wima Printilyt		470uF 35V Wima Printilyt	1000uF 35V Wima Printilyt				2200uF 63V Mullard	
C51b	–	–	47uF 40V Mullard 121/17399	47uF 40V Mullard 121/17479				2 x 47uF 40V	
C51c	–	–	–	–		470uF 35V Wima Printilyt		1000uF 35V	
C52	0.1uF 160V Wima Tropyfol M			0.22uF 400V Wima Tropyfol M				2.2uF 100V Wima Tropyfol M	
MR11	IN4003	IN5402		PM6A2Q		40HF20			MR1202FL
MR12	IN4003	IN5402		PM6A2Q		40HF20			MR1202FL
MR50	IN4003		3F10		40HF10			40HF20	2 x 40HF20
MR51	IN4003		2 x IN4003					IN5402	
VT50	2N3055		2 x 2N3055		5 x 2N3055	6 x 2N3055	8 x 2N3055	13 x 2N3055	26 x 2N3055
VT51	–	–	2N3055						
T1	T147/9 / T147/9	T78/11	T78/7	T78/13	T120/16 / T120/17	T248/2	T248/3	T638C/2	T638C/3
L1	–	–	–	–	–	–	–	L78/4	L78/5

ASB/ATB FRAMEWORK COMPONENTS

Circuit Ref.	ASB 50 / ATB 50	ASB 100 / ATB 100	ASB 200 / ATB 200	ASB 300 / ATB 300	ASB 500 / ATB 500	ASB 700 / ASB 1000	ASB 1500	ASB 2000	ASB 3000
R50	2 ohms 5% 3W W/W	1 ohm 5 % 3W W/W	0.5 ohms 5% 5W W/W	2 x 0.5 ohms 5% 5W W/W		6 x 0.5 ohms 5% 5W W/W	8 x 0.5 ohms 5% 5W W/W		13 x 0.5 ohms 5% 5W W/W
R51	–	–	–	1 k ohm 5% 3W W/W					
R52	–	–	–	–	–	–	–	–	–
RV1	500 ohms 5% Bourns 3067 P-1-501								
C50	1300uF 50V Sprague 36D 132G 050 AA2A	2600uF 50V Sprague 36D 262G 050 AB 2A	2 x 2600uF 50V		2 x 5500uF 40V Sprague 36D 552G 040 AC 2A	2 x 12000uF 40V Sprague 32D 123G 040 CC 2A	4 x 7300uF 40V Sprague 32D 732 040 BC 2A	2 x 21000 40V Sprague	
C51a	220uF 35V Wima Printilyt					470uF 35V	2200uF 63V Mullard C432	1400uF 64V Mullard C432	
C51b	–	–	–	47uF 40V Mullard C415	47uF 40V Mullard 121-17479				
C51c	–	–	–	–	–	–	470uF 35V + 1000uF 35V Wima Printylit		
C52	0.1uF 160V Wima Tropyfol M				0.22uF 400V Wima Tropyfol M			2.2uF 100V	
MR11	2 x IN4003		2 x IN5402	BR92A	PM7A2Q	MDA990-2		2 x 40HF20	
MR12	2 x IN4003		2 x IN5402	BRIDGE	BRIDGE	BRIDGE		2 x 40HF20	
MR50	IN4003			3F10		40HF10		40HF20	
MR51	IN4003					2 x IN4003		IN5402	
VT50	2N3055			2 x 2N3055		6 x 2N3055	8 x 2N3055		13 x 2N3055
VT51	–	–	–	2N3055					
T1	T147/10	T29/7	T78/8	T152/4	T78/14	T120/18	T248/4	T248/5	T638C/4
	T78/18	T78/19	T78/21	T120/26	T120/27	T120/19			
L1	–	–	–	–	–	–	–	–	L120/3

ASC/ATC FRAMEWORK COMPONENTS

Circuit Ref.	ASC 50 / ATC 50	ASC 100 / ATC 100	ASC 200 / ATC 200	ASC 300 / ATC 300	ASC 500 / ATC 500	ASC 700 / ASC 1000	ASC 1500	ASC 2000	ASC 3000
R50	2 ohms 5% 3W W/W		2 x 1 ohm 5% 3W W/W		4 x 0.5 ohms 5% 5W W/W	6 x 0.5 ohms 5% 5W W/W	7 x 0.5 ohms 5% 5W W/W	9 x 0.5 ohms 5% 5W W/W	13 x 0.5 ohms 5% 5W W/W
R51	–	–	–	1k ohm 5% 3W W/W					
R52	–	–	–	–	–	–	–	–	–
RV1	1 K ohm 5% Bourns 3067 P-1-102								
C50	1300uF 50V Sprague 36D 132G 050 AA 2A	2600uF 50V Sprague 36D 262G 050 AB 2A	2 x 2600uF 50V	5800uF 50V Sprague 32D 582G 050 BC 2A	10000uF 50V Sprague 32D 103G 050 CC 2A	2 x 10000uF 50V	3 x 10000uF 50V	2 x 15000uF 75V Sprague 36D 153F 075 CF 2A	
C51a	200uF 35V Wima Printilyt			470uF 35V Wima Printilyt					
C51b	–	–	–	47uF 40V Mullard 121-17479					
C51c	–	–	–	–	–	–	1000uF 35V Wima Printilyt 2200uF 63V Mullard 106 38222		
C52	0.1uF 160V Wima Tropyfol M			0.22uF 400V Wima Tropyfol M			2.2uF 100V		
MR11	2 x IN4003		2 x IN5402	BR92A	PM7A2Q	MDA 990-2	40HF20 40HFR20		
MR12	2 x IN4003		2 x IN5402	BRIDGE	BRIDGE	BRIDGE	40HFR20 40HF20		
MR50	IN4003			3F10		40HF10			
MR51	IN4003				2 x IN4003		IN5402		
VT50	2N3055		2 x 2N3055		4 x 2N3055	6 x 2N3055	7 x 2N3055	9 x 2N3055	13 x 2N3055
VT51	–	–		2N3055					
T1	T147/11 T78/20	T78/9 T152/5	T152/3 T120/25	T78/15 T248/8	T120/20 T248/9	T248/6 T248/7	T638C/5	T638C/6	T638C/7
L1	–	–	–	–	–	–	–	L120/4	L120/5

ASD FRAMEWORK COMPONENTS

Circuit Ref.	ASD 50	ASD 100	ASD 200	ASD 300	ASD 500	ASD 1000
R50	2 ohms 5% 3W W/W	2 x 2 ohms 5% 3W W/W	4 x 2 ohms 5% 7W W/W	6 x 2 ohms 5% 7W W/W		8 x 2 ohms 5% 7W W/W
R51	–	–	2 K ohms 5% 3W W/W			5K ohms 5% 7W W/W
R52	15 K ohms ¼W					
RV1	1K ohm 5% Bourns 3067 P-1-102					
C50	900uF 100V Sprague	2 x 900uF 100V	3300uF 100V Sprague		4700uF 100V Sprague	2 x 10000uF 100V Sprague
C51a	150uF 100V Erie 21 105 100					
C51b	–	–	–	–	–	900uF 100V
C51c	–	–	–	–	–	–
C52	0.1uF 160V Wima Tropyfol M		0.22uF 160V Wima Tropyfol M			
MR11	2 x IN4003		PM7A2Q BRIDGE	PM7A4Q BRIDGE	SKB 30/02 A1 SEMIKRON BRIDGE	40HF20 40HFR20
MR12	2 x IN4003					40HFR20 40HF20
MR50	IN4003		3F10		40HF10	40HF20
MR51	IN4003				IN5402	
VT50	2N3442	2 x 2N3442	4 x 2N3442	6 x 2N3442		8 x 2N3442
VT51	–	–	2N3442			
T1	T78/20	T152/5	T120/25	T120/68	T298/9	T638C/34

SECTION 7

Overvoltage Protection

7.1. Overvoltage protection is fitted as standard to all units in the ASA range. It is available as an optional extra in the ASB, ASC and ASD ranges.

Except for size 15 (19") units, the extra components fitted are a D.C. fuse, OV module (either a "KROP" or "KRO") and a potentiometer (with "KROP" only). In addition an SCR is sometimes fitted depending on the units current rating (see Table F below). These extra components are accommodated on the existing control board type 11101 or 11102. See Fig. 6 and 7.

Size 15 (19") units are fitted with a separate OV board. See Fig. 8.

Recommended d.c. fuse ratings are listed in Table E.

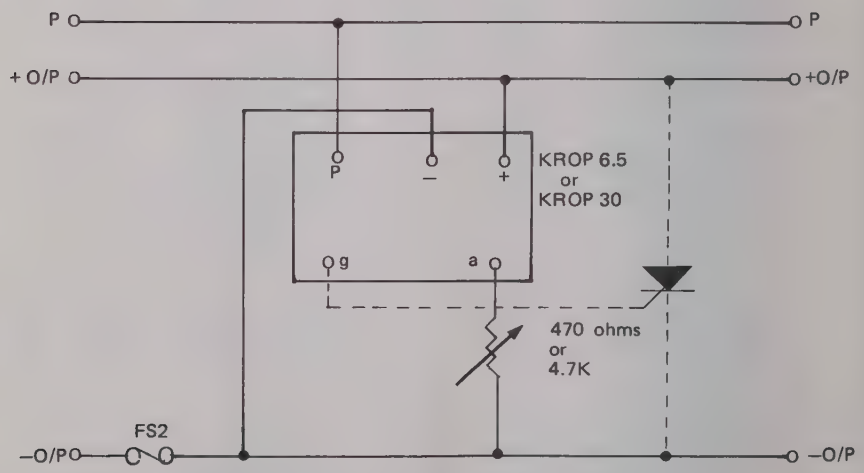
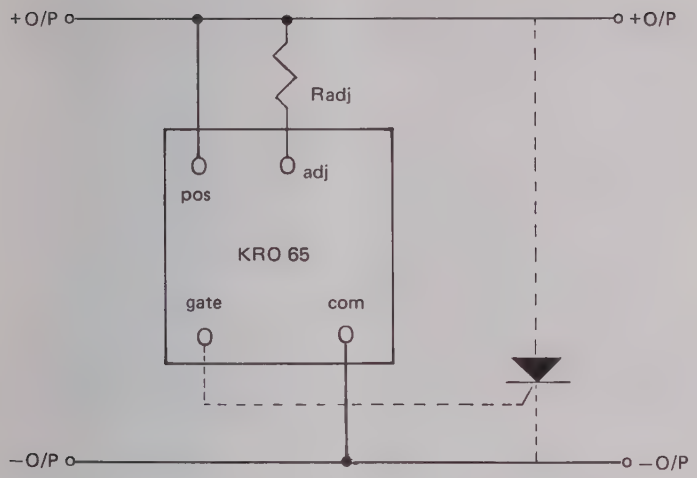


Fig. 6. OV circuit fitted to all units except ASD range and size 15 (19") units.



Set Volts (approx.)	35	38	40	45	50	59	62	65
Radj	27K	33K	39K	56K	82K	127K	200K	–

Fig. 7. OV circuit fitted to ASD units only.

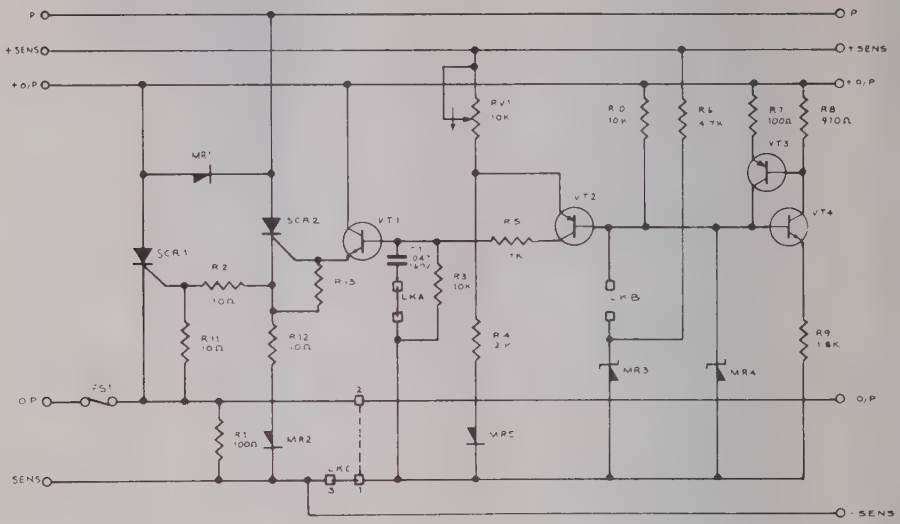


Fig. 8. OV circuit fitted to Size 15 (19") units only.

Note: Make link LKB for voltages in range 1-8 volts.
Open link LKB for voltages in range 8-30 volts.
RV1 provides firing voltage adjustment for both ranges.

7.2. Setting up Procedure for OV Circuits.

The unit is normally factory set at 110% of the output voltage, (but higher on 5V units). If remote sensing is used or if a different overvoltage limit is required the resetting procedure is as follows:

Set the firing voltage of the OV circuit to maximum (see Figs. 6-8 for details).

Apply full load to the unit if remote sensing is being used.

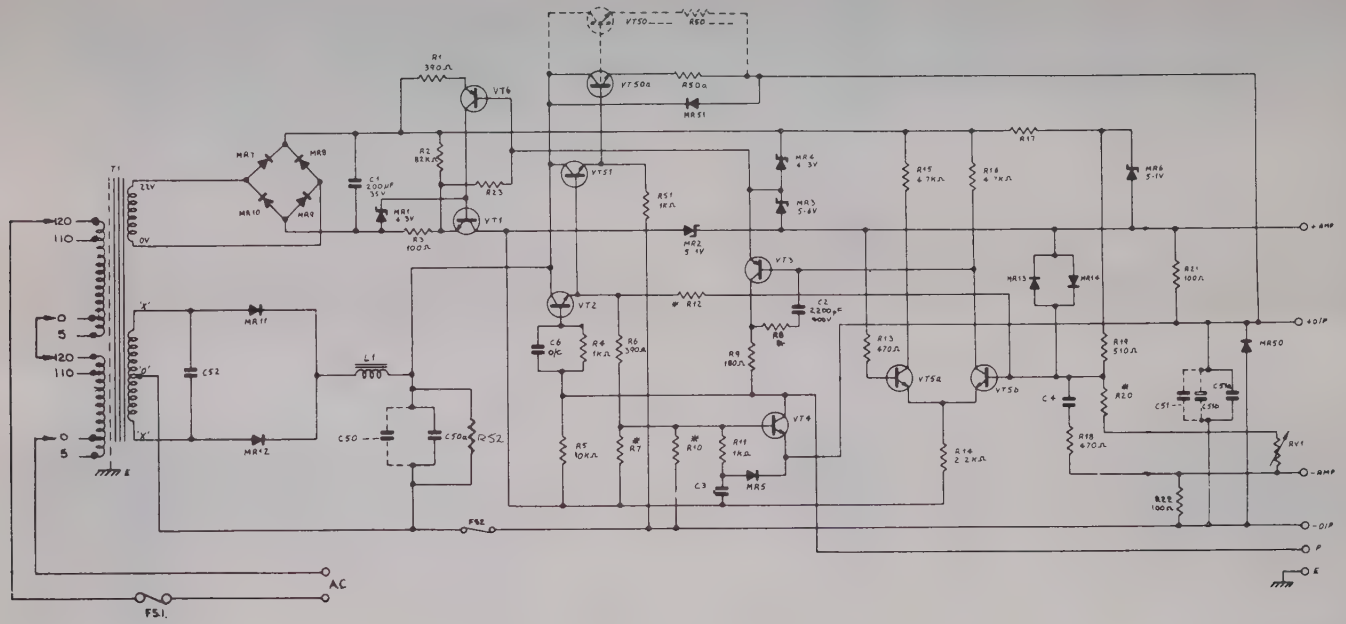
Set the power supply voltage to the required firing voltage of the OV circuit. Reduce the firing voltage of the OV circuit (by potentiometer or suitable fixed resistor depending on circuit installed), until the output voltage suddenly drops to zero. Switch the power supply off. Turn the power supply output potentiometer approx. four turns in an anticlockwise direction. Switch on the power supply and by slowly increasing the output voltage check the voltage at which the output drops to zero again. When the unit is adjusted satisfactorily, reset the power supply to the required output voltage.

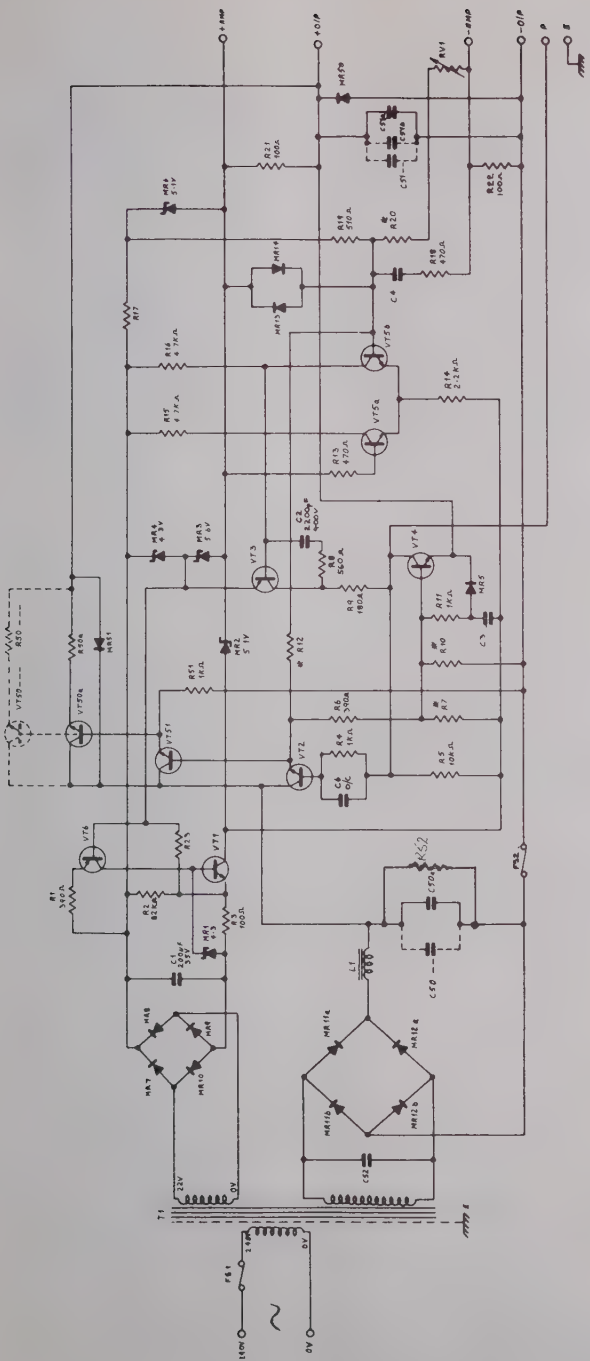
TABLE F.

Recommended SCR types (when fitted).

Max. Output Current of Unit	3A	5A	7A	10A	15A	20A	30A	50A
Recommended SCR Type	2N4441*		2N6504*		CR27-101-B			

*These components are usually mounted on the control board.


T1
120
110
0
5
120
110
0
5
12V
0V
'X'
0'
'X'
E
MR7
MR9
MR10
MR8
C1
200μF
35V
MR1
4.3V
R2
82KΩ
R23
R3
100Ω
VT6
VT1
R1
390Ω
VT50
R50
VT50a
R50a
MR51
VT51
R51
1KΩ
MR2
5.1V
VT3
VT2
R12
C2
2200μF
40V
R8
R9
180Ω
MR4
4.3V
MR3
5.6V
R15
4.7KΩ
R16
4.7KΩ
R17
MR6
5.1V
MR13
MR14
R21
100Ω
+AMP
+O/P
MR50
R13
470Ω
VT5a
VT5b
R19
510Ω
C4
R20
C51
C51a
C51b
RV1
-AMP
R18
470Ω
R14
2.2KΩ
R22
100Ω
-O/P
P
E
C6
0/C
R4
1KΩ
R6
390Ω
R5
10KΩ
R7
R10
R11
1KΩ
C3
MR5
VT4
MR11
MR12
C52
L1
C50
C50a
RS2
FSE
AC
FS1.



WARNING

When the mains supply is connected to the mains connector block on a power supply dangerous voltages will be present on some components within the unit.

HEALTH AND SAFETY AT WORK ACT 1974

We have reasonable grounds to believe that we have ensured, so far as is practicable, that our product has been so designed and constructed as to be safe and without risks to health, when properly installed and used in its intended environment by appropriate and trained personnel, and in accordance with our published instructions.

SPARES AND SERVICE

1. A full stock of tested spare parts is held at our Ilfracombe factory for customers who require to repair units themselves. The nature of the circuitry does not permit changing of components on the P.C.B's without special test facilities, however whole P.C.B. assemblies are available as spares. See parts lists for type numbers.

2. When returning units to our Service department please ensure they are adequately packed for the journey. The units must also be accompanied by information as to their origin, and the nature of the defect. This information will greatly assist us in giving a speedy turn round, please supply too much information rather than too little.

ADDRESSES

Sales
3 Trafford Road, Reading, Berks RG1 8JR
Tel. No. Reading (0734) 55391
Telex 847519

Service and Spares
Kingsley Avenue, Ilfracombe, N. Devon EX34 8ES
Tel. No. Ilfracombe (0271) 63781
Telex 46310

Coutant Electronics Limited
Reading, RG1 8JR
England
Telephone: Reading (0734) 55391-5
Telex: 847519

Coutant Electronics Limited
Ilfracombe, Devon
England
Telephone: Ilfracombe (0271) 63781
Telex: 46310